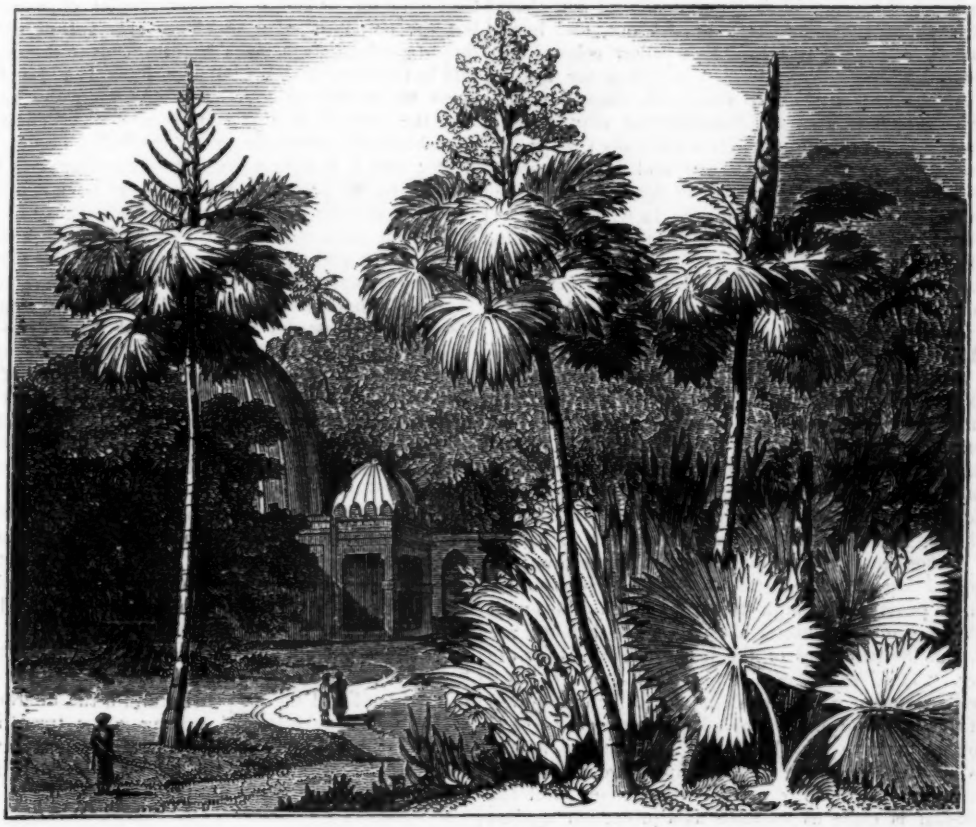
THE PENNY MAGAZINE

OF THE

Society for the Diffusion of Useful Knowledge.

81.] PUBLISHED EVERY SATURDAY. [JULY 6, 1833.

THE TALIPOT TREE OF CEYLON.



[Talipot Palms in different stages of growth.]

THERE are few objects in the vegetable kingdom more remarkable and beautiful, or more useful to man, than the Talipot-tree, which is a species of palm (the *corypha umbraculifera* of Linnæus) peculiar to the Island of Ceylon, and the Malabar coast*. Robert Knox says that it is as big and as tall as a ship's mast, but Cordiner gives more definite dimensions by stating that one which he measured was a hundred feet high and five feet in circumference near the ground. The stem of this tree is perfectly straight; it gradually diminishes as it ascends, the circumference of the upper part being about half that of the base: it is strong enough to resist the most violent tropical winds. It has no branches, and the leaves only spring from its summit. These leaves, which when on the tree are almost circular, are of such prodigious diameter that they can shelter ten or a dozen (Knox says from fifteen to twenty) men, standing near to each other. The flower of the tree which shoots above the leaves is at first a cluster of bright yellow blossoms, exceedingly beautiful to the eye, but emitting an odour too strong and pungent to be agreeable. Before its development the flower is enclosed in a hard rind, which rind, upon the expansion of the flower, bursts with a sharp noise. The flower shoots pyramidically to a great height, frequently adding as much as thirty feet to the elevation of the tree. From the flower proceed the fruit or seeds, which are as large as our cherries, and exceedingly numerous, but not eatable: they are only useful as seeds to reproduce and multiply the tree. It appears that the natives do not sow them, but leave that operation entirely to nature. The flower and the fruit only appear once on one tree. Their appearance betoken that the tree has attained to old age, which, according to the natives, it does in a hundred years: Ribeyro, a Portuguese writer, says, in about thirty years, which is more likely to be correct. As soon as the fruit or seeds are ripe, the tree dries up and decays so rapidly that in two or three weeks it is seen prostrate and rotting on the ground. Knox asserts, that if the tree be cut down before it runs to seed, the pith, largely contained within the stem, is nutritious and wholesome, and adds that the natives take this pith, "and beat it in mortars to flower, and bake cakes of it, which taste much like to wheat bread, and it serves them instead of corn before their harvest be ripe." We have not found these cakes mentioned by any other writer on Ceylon; but as Knox

* It is said to be found also in the Marquesas and Friendly Islands.

LONDON: PUBLISHED BY C. KNIGHT, 90, FLEET STREET.—PRINTED BY WILLIAM CLOWES, DUKE-STREET, LAMBETH.

was so veracious and correct, we may admit that the natives were accustomed to make them. A better known fact about the uses of the inner parts of the tree is that sago is made from them. The stem or trunk of the talipot, like that of most other palms, is extremely hard without, but soft and spongy within, the greater part of its diameter being a soft brownish cellular substance. The sago is made by beating the spongy part of the stem in a mortar, by which means the fecula is procured. Still, however, the great usefulness of the tree is in its leaves. Growing on the tree, these leaves when expanded, are of a beautiful dark green colour; but those chiefly used are cut before they spread out, and have, and retain for ages, a pale brownish yellow colour, not unlike old parchment. Their preparation for use is very simple: they are rubbed with hard, smooth pieces of wood, which express any humidity that may remain, and increase their pliability, which is naturally very great. The structure of this wonderful leaf and the disposition of its fibres will be best understood by a glance at the engraving at the head of this article, in which the construction of the leaves is shown, particularly by those in the right-hand corner.

Our readers will there see that it is made precisely like a fan, and like a fan it can be closed or expanded, and with almost as little exertion. It is in fact used as a fan by the natives of Ceylon, and is at the same time their only umbrella and parasol; in addition to which uses it forms their only tent when they are in the field, and, cut up into strips, it serves them to write upon instead of paper.

The leaf is so light that an entire one can be carried in the hand; but as this, from its great size when expanded, would be inconvenient, the natives cut segments from it, which they use to defend themselves from the scorching rays of the sun, or from the rains. The narrow part is carried foremost, the better to enable those who use them, to penetrate through the woods and thickets with which most of the country abounds. No handles are used, but the two sides of the leaf are grasped by the bearer. "This," says Knox, in his quaint manner, "is a marvellous mercy which Almighty God hath bestowed upon this poor and naked people in this *rainy country*!" He ought to have added, in this *hot country*, for the heats of Ceylon, whose mean temperature is 81°, are frequently, and for long periods, tremendous, and the talipot-leaf is quite as valuable as a protection against them as against rain.

However much water may fall on the leaf it imbibes no humidity, remaining dry and light as ever. The British troops in their campaign in the jungles against the Cingalese in 1817 and 1818, found to their cost how excellent a preservative it was against wet and damp. The enemy's musket-men were furnished, each with a talipot-leaf, by means of which they always kept their arms and powder perfectly dry and could fire upon the invading forces; whilst frequently the British muskets, which had no such protection, were rendered useless by the heavy rains, and the moisture of the woods and thickets, and our men consequently unable to return the fire of the natives.

As tents, the talipot-leaves are set up an end as described in the adventures of Robert Knox, No. 75, of our Magazine. Two or three talipot-umbrellas thus employed make an excellent shelter, and from being so light and portable, each leaf folding up to the size of a man's arm, they are admirably adapted for this important service. The chiefs, moreover, have regularly formed square tents made of them. In these the leaves are neatly sewed together and laid over a light frame-work: the whole is light and can be packed up in a very small compass.

When used in lieu of paper, they are, as we have mentioned, cut into strips, (those which we have seen are about 15 inches long by 3 broad,) soaked for a short time in boiling water, rubbed backward and forward over a smooth piece of wood to make them pliable, and then carefully dried. The Cingalese write or engrave their letters upon them with a stylus, or pointed steel instrument, and then rub them over with a dark-coloured substance, which only remaining in the parts etched or scratched, gives the characters greater relief, and makes them more easy to read. The colouring matter is rendered liquid by being mixed with cocoa-nut oil, and when dry is not easily effaced. On common occasions they write on the leaf of another species of palm-tree, but the talipot is used in all government despatches, important documents, such as title-deeds to estates, &c., and in their books. A Cingalese book is a bundle of these strips tied up together*. As even the lawyers and the learned in this country are very deficient in chronological knowledge, great confusion occurs as to dates; and it is very common to see a Cingalese judge attempting to ascertain the antiquity of a document produced in court by smelling and cutting it.

The oil employed in the writing imparts a strong odour which preserves it from insects, but this odour is changed by age. The talipot, however, appears to have in itself a natural quality which deters the attack of insects and preserves it from the decay of age even without the oil. It may be worth while observing that the Cingalese who engrave the most solemn of their deeds, such as the foundation of, or donations to a temple, on plates of fine copper, which are generally neatly edged with silver, always make these plates of precisely the same shape as the talipot strips used for writing.

Besides all the uses described, the Cingalese employ the talipot-leaf extensively in thatching their houses. They also manufacture hats from it; these hats are made with brims as broad as an out-stretched umbrella, and are chiefly worn by women nursing, to defend them and their infants from the heat.

The talipot is not a very common tree at present, and is rarely seen growing by those who only visit the coasts of the island and do not penetrate into the interior. It seems to grow, scattered among other trees, in the forests. In a view of the town of Kandy, as it was in 1821, a fine specimen of the talipot, in flower, is seen close to a group of cocoa-nut trees.

THE LABOURERS OF EUROPE.—No. 6.

In treating of the labourers of such an extensive country as France, it would be unreasonable to speak of them as one class. There are great and material differences of localities, of climate, and of habits, between populations placed at a distance of six or seven hundred miles from each other,—between the inhabitants of the coasts of the Mediterranean and those who live near the British Channel,—between those on the banks of the Rhine and those on the shores of the great Atlantic Ocean. Their respective wants, the produce of the soil, the wages of labour in each of their divisions, are essentially different. The great divisions of France may be considered to be, 1st. The north and north-eastern provinces. 2d. The central provinces. 3d. The southern provinces; and, 4th. The western provinces. Again, we must not judge of the condition of French labourers, and French villagers, by those we meet on the high roads near Paris and other great cities; but we ought to look at those in the interior, at a distance from the great markets and thoroughfares, and who, in a country where large towns are few and far between, constitute by much the great majority of the whole population. We have endeavoured to extract the best information we could collect from trustworthy authorities of the condition of

* Many of the books shown in Europe for the Egyptian papyrus, are made of the leaves of the talipot.

the French labourers at three different epochs; namely, 1st. Before the French revolution. 2d. Under Bonaparte's government. 3d. Since the last peace, and up to the present time.

The depression of French farmers and labourers before the revolution may be ascribed to two principal sources; 1st. The bad system of the tenure of the land. 2d. The weight and inequality of taxation.—The tenure of land was of four kinds: 1st. Small properties cultivated by the owners, who were mostly, at the same time, in the condition of daily labourers. These, contrary to the current supposition of people in our days, were very numerous even before the revolution. Mr. Arthur Young, who was intimately acquainted with the subject, states that one-third of the land in France was so divided. At the death of the owner these little properties were subdivided, in some instances among all the sons, and in other places among all the children, male and female. "At last," says Mr. Young, "you find a family living, or rather starving, upon half an acre of ground, with one single fruit-tree standing upon it." 2d. Rent-farms, as in England, but generally of small size. These were found chiefly in the northern provinces, and hardly extended over a sixth part of the kingdom. 3d. Feudal tenures, granted by the lords of the ground, with the conditions of census, forfeiture, fines, services, &c. These were scattered all over the kingdom. 4th. Lands held by *metayers*, who gave the landlord one-half of the produce in kind, the latter furnishing the cattle and one-half of the seed, and the occupier providing the implements of agriculture. In some places the landlord paid also one-half of the taxes. This mode of holding lands was by far the most prevalent over the greater part of the kingdom, and as it continues to prevail to this day, in spite of all political and other changes, we shall have occasion to revert to it again hereafter. There were also speculators (middle-men), who rented vast tracts of land, and then sub-let them again in small portions to metayers, who gave them one-half of the produce. The consequences of the metayer system are obvious—it rears up a population of paupers. The metayer, after paying one-half of the produce of his small farm, could hardly derive a bare subsistence for himself and family. His implements were wretched, and sparingly provided. The repairs of buildings, the hedges, gates, palings, &c. were likewise neglected; the land deteriorated, there being little or no manure, owing to the deficiency of cattle on the farms. The rotation of crops all over France was bad, consisting of alternate fallow and wheat crops, then fallow, and barley or oats; no turnips, clover, or beans being interposed. Mr. Young, in a work in which he treats professedly of the agriculture of France in his time*, gives the following list of prices of provisions and wages:—Average wages of journeymen in France 19 sols, masons and carpenters 30 sols; at the same time labourers' wages in England were 1*s.* 4½*d.*, or 33 French sols. Meat was then in France 7 sols. per lb., bread 2 sols. In England, at that time, meat was 4½*d.*, equal to 8½ sols; and bread 1¾*d.*, equal to 3½ sols. By taking the difference in the price *of bread and meat conjointly* between the two countries, it resulted that the English labourer's wages compared to the French were as 25½ to 19. If the difference in the price of bread *alone* is considered, then the wages were alike in both countries. But this would not have been a fair estimate; for, besides meat being almost as essential an article as bread, the French common bread in the country was always of a very inferior quality, being made with a large proportion of rye and other grains, for as to the price of wheat in both countries the difference was trifling. Again, the English peasantry eat a considerable quantity of cheese and butter, and the French hardly any. There is even at this day a great scarcity of good cheese in France; there are but one or two kinds of tolerable cheese made in the country, and those in small quantity, and very dear. Roquefort cheese, which is the best, costs two francs the pound at Paris, 1*s.* 8*d.* English. The reason of the dearness of good meat in France Mr. Young ascribed to the want of artificial meadows: in winter sheep were fed almost entirely upon straw. "The sheep," says he, "are extremely lean; I have not seen a sheep in France that would be called fat in England. Their mutton appears hardly eatable to an Englishman. Beef is very good at Paris and in other large towns, where prime bullocks are sent from Limousin or Normandy; but in the provincial towns and villages old cows are slaughtered, and good beef is as scarce as good mutton." This was written in 1789, and things have somewhat mended since; yet the leading features of Mr. Young's remarks hold good in great measure to this day, as we shall hereafter see.

We now come to the second cause of agricultural depression in France before the revolution, namely, a bad system of taxation. The taxes were of two sorts—direct and indirect. The former consisted chiefly of two heads, *tailles* and *capitation*.

The *taille* was of two sorts, *real* and *personal*. The real taille was a land-tax at so much per acre. The personal taille was assessed on the personal estate of each individual, that is to say, his money, rental, houses, profession, *industry*, or either of these. The manner in which it was levied was very arbitrary. Every year the king in council determined the amount of tax to be raised from the whole kingdom. This was then divided among the different provinces, each intendant or king's lieutenant assessing the different districts within his province for their respective shares; and lastly, the elders of each parish, in presence of the justice and syndic, taxed each individual for his quota. No appeal was allowed. In a curious old pamphlet, called 'A compendious History of the Taxes in France,' printed in 1694, during the reign of Lewis XIV., we find the following particulars:—"The great evil of the taille is the unequal manner in which people are assessed by the authorities and by the collectors, who favour their own friends to the detriment of the rest. Industry is taxed, so are talent, exertion, and success. Every improvement a farmer makes on his ground exposes him to a heavier taille. A poor cobbler or other artizan, who has nothing in the world but his labour, is assessed four or five crowns a-year. A baker at Gonesse, near Paris, who has not an inch of land, is assessed for his personal estate 1,200 French crowns." The personal taille was not paid by either the nobility or clergy; but the real taille or land-tax was levied on all estates which were not holden by feudal tenure. The clergy, however, paid what was called a *free gift* to the crown, which was voted at fixed periods in their own assembly, and to which all incumbents contributed their share. There was also a sort of capitation tax on the clergy called the *general tenth*, levied on all except the mendicant friars who had no property.

The early division of the old French monarchy was in two great parts, *Langue d'oc*, or south; and *Langue d'oïl*, or north. The latter paid personal taille, while the former paid only the real taille. Burgundy and Britanny, although northern provinces, did not form part of the Langue d'oïl: having for a long time constituted independent duchies, they had preserved their own states or parliaments. These provinces, as well as Languedoc and Provence, were therefore called *pays d'etats*, while the rest were called *pays d'election*, or without states, whose inhabitants were taxed by the will of the government, and assessed by their *elus*, or notables. In the former provinces the states were asked by the king for a certain grant, and they ordered the assessment: the nobility,

* Young's Travels in France in the Years 1787–89. 2 vols. 4to. 1794.

clergy, and swordsmen paid according to the value of the land they were in possession of; merchants, artificers, and tradesmen, were assessed according to their station. But day-labourers and other poor persons were not liable to personal taille, and this was a great advantage they had over those in the rest of France. The pays d'etats, however, paid every two years what was called a free gift for the preservation of their privileges, for which purpose all the inhabitants in general were taxed. The conquered provinces, Alsace, Lorraine, Flanders, Franche Comté, and Rousillon enjoyed the same privilege as the state countries.

The capitation tax was levied upon every individual, without exception of rank, from the dauphin to the poorest labourer.

There were numerous taxes on consumption, such as *aides*, or excise duties, upon wine and spirits, levied first in the cellar, on the cask, and afterwards on the retailer, amounting to double the original value. There was besides, and there is still, a general *octroi*, or barrier duty, on every article of provision brought into Paris and other cities. In Lewis XIV.'s time this duty was 9*s.* for every bullock, 3*s.* 6*d.* for a calf or pig, 2*s.* 6*d.* for a sheep; other articles, such as fish, poultry, butter, eggs, cheese, vegetables, firewood, &c., paid at the rate of one-fifth of their value.

There was a house-tax at Paris and in other cities; also licences for every shop or trade, including hawkers; a tax on public carriages, toll-duties, registry; stamp on paper, parchment, metals, leather, &c.; taxes on tallow, oil, soap, tobacco, &c.

One of the most oppressive taxes was that on salt. Salt was and still is in France, as well as in most countries of the continent, a monopoly of the government. All proprietors of salt-pits were obliged to sell their salt at a low price into the government stores, from which alone the retailers and the people in general could supply themselves, and this rule was strictly enforced by the most severe penalties. The profit on this article was calculated at several hundred times its original value. It was sold at eleven sols, or five-pence halfpenny the pound. In the country every family was assessed for a certain proportion of salt in proportion to the number of its members, which they were forced to purchase from the officers of the *gabelle*, or revenue. This is still the practice in several states of the continent.

But the worst part of the whole system was that most of these taxes on articles of consumption were farmed to speculators who outbid each other, and paid a large premium for the lease, of which they made of course the most they could by squeezing out of the people much more than what they paid into the treasury. Just before the revolution the farms paid into the treasury about five millions sterling, but it was calculated that they cost the people at least twice as much. The whole revenue of France, including the domains of the crown, the *free gifts* of the clergy and of the state provinces, the additional tenths on the capitation tax, &c., and which, under Lewis XIV., had been raised to 750 millions, or 30 millions sterling, amounted in 1789 to 475 millions of livres, or about nineteen millions sterling. It rose under Necker's administration to 568, or near about twenty-two millions and a half. France now pays more than double that amount, and yet the people do not feel the burthen so heavy as they did then, owing to the better and more equal distribution of taxation, and to the great increase of industry, trade, and national resources.

"In every country," thus wrote Dr. Moore in 1779 *, "there is poverty in the large towns, often produced by vice, idleness, or improvidence, but in France the poorest inhabitants of the capital are often in a better condition than the laborious peasant. The former, by administering to the luxuries or taking advantage of the follies of the great and the wealthy, may procure a tolerable livelihood and sometimes make a fortune, while the peasant cannot without much difficulty earn even a scanty and precarious subistence. In order to retain a favourable notion of the wealth of France, we must remain in the capital, or visit a few trading or manufacturing towns; we must not enter the château of the seigneur, or the hut of the peasant. In the former we shall find nothing but tawdry furniture, and from the other we shall be scared by penury. In every country a failure of crops, or other accidental circumstances, may occasion distress and scarcity among the common people at a particular time: but when there is a permanent poverty through several reigns and for a long tract of years among the peasantry of such a country as France, this seems to me the truest proof of a careless and consequently an oppressive government."

* A View of Society and Manners in France, Switzerland, &c.

Another of the burthens of the French peasantry, was the *corvées*, or forced labour which they were called upon to perform, gratis, for the lord of the manor or feudal estate. This power was left to the discretion of the local agent or steward, and was a source of infinite vexations and oppressions. The service of the corvées had never been regulated by any edict or law. This obnoxious practice, however, was abolished in 1776, several years before the revolution, and its suppression was one of the first acts of Lewis XVI.'s reign. In fact things had begun to improve, when the violence of the revolution threw the whole social system into confusion, and many years of universal distress rolled over France before the labouring classes could derive any benefit from the sweeping change. What these benefits were, and how far they extended, we shall see in a future number.

From what we have said, it will appear that the condition of the French labourers in the last century, although generally depressed, varied considerably in different localities, according as they lived on feudal or free estates, in state provinces or in those without assemblies; it was in truth left a great deal to chance, and the disposition of the local rulers. In several parts, the nobles and landlords lived in harmony and kind intercourse with their tenants and labourers, and then the lot of the latter was tolerably happy. And the effects of this were seen amidst the revolutionary storms that followed. The peasantry of the districts we allude to stood by their landlords, their nobility, and their clergy, against the sweeping decrees of the Paris Convention, and fought long and desperately against the troops of the latter. We need only name La Vendée, to recall these facts to the minds of our readers.

Utility of Dogs.—The dogs of Constantinople belong to every body and to nobody, the streets are their homes; their appearance is between a wolf and a jackal. It is astonishing how they continue their species, exposed to a rigorous winter, and the casualties of a large city. They are littered and reared in the streets. In the summer several die of thirst, *but none are ever known to go mad.* Though a worrying nuisance to walkers, their general utility is obvious; for as the Turks throw the leavings of their kitchens out of doors, the streets would very soon be impassable but for the scavenger-like propensities of the dogs and the storks, assisted occasionally by vultures. As they subsist entirely on charity and what they pick up, instinct teaches them the necessity of a division of labour; and therefore, in the same manner as a well-regulated society of beggars has separate walks for its members, they divide the city and its suburbs into districts. Were a dog found in a strange quarter, he would infallibly be torn in pieces by the resident dogs; and so well are they aware of this, that no argument, not even a bone of roast meat, will induce a dog to follow a person beyond his district; a singular and authenticated fact. We caressed for experiment one of these animals, whose post with many others was near the Mevlevi Khan; we daily fed him till he became fat and sleek, and carried his tail high, and was no longer to be recognized for his former self. With his physical, his moral

qualities improved. He lost his currishness, and when his patrons approached, expressed gratitude by licking their hands, &c.; yet he would never follow them beyond an imaginary limit, either way, where he would stop, wag his tail, look wistfully after them till they were out of sight, and then return to his post. Once only I saw him overstep his limit; he was very hungry and we were alluring him with tempting food; but he had not exceeded twenty yards when he recollected himself, and ran hastily back. I cannot say if any order of precedency is observed in gaining the best stations, as near a butcher's shop or a Khan.—*From Mr. Slade's Travels in Turkey, Greece, &c.*

THE CARTOONS OF RAFFAELLE.—No. 7.

ELYMAS STRUCK WITH BLINDNESS.

The scenery of the Cartoons is here diversified with a Prætorium, or Roman hall of justice. The composition is of that kind in which the middle space is left vacant, the figures being arranged on a semicircular line, and extending from one side of the picture to the other; an arrangement admirably adapted to this subject. The Proconsul Sergius Paulus, surrounded by his officers and lictors, is seated on his tribunal in front of a recess in the centre of the hall. Paul and Elymas are the foremost figures in the composition, placed on each side of the magistrate, and confronting each other. During the first promulgation of Christianity the preaching of the Apostles, and the fame of their miracles, instigated a number of impostors to an assumption of similar

functions; among these, Bar-jesus, called Elymas, "a false prophet and a sorcerer," was one of the most conspicuous; he appears to have obtained considerable credit, and on the arrival of Paul and Barnabas at Paphos, had the audacity to challenge them to a public discussion before Sergius Paulus, with the hope of preventing the proconsul from embracing the Christian faith. The presumption and impiety of Elymas was met by this denunciation from the lips of the apostle: "Behold! the hand of the Lord is upon thee, and thou shalt be blind, not seeing the sun for a season. And immediately," continues the sacred narrative, "there fell on him a mist and darkness, and he went about, seeking some one to lead him by the hand."

Elymas is annihilated by this calamity; he no longer exhibits the front or bearing of the subtle disputant or daring impostor. His whole action—the person bent, the arms and hands stretched out, one leg cautiously advanced, while the other sustains the weight of the figure, all indicate the confused and uncertain feeling of one struck with sudden blindness,—all is expressive of astonishment, affliction, and dismay. The group behind him, amidst much variety of action, is connected by an admirable chain of expression: one of the male figures points to Elymas; the other to Heaven; the female, on the contrary, who is no doubt meant for the wife of Elymas, protests aloud against the infliction, ascribing it to human malice, and pointing indignantly at St. Paul as the author of it. The officer who stands on the steps of the tribune, extends his hand towards the sorcerer, and turning to the surrounding crowd, seems to say, "Behold the judgment which has fallen on him!" while the man on the right of Elymas gazes on his face with such an intensity of wonder and curiosity as gives an air of reality to the whole scene.

Elymas is the personification of detected falsehood: St. Paul appears the image of irresistible truth; simple, erect, decisive, he stands in the calm consciousness of power, and it is only from his upraised arm and finger that we perceive it is from him that the impostor has received his doom. The whole composition is in the highest degree picturesque, although not the slightest sacrifice of propriety is made for that object; an air of decorum even, proper to a hall of justice, is preserved amidst all the excitement of the scene; the figures of the lictors are admirably characteristic, the procunsul himself has a striking air of grandeur and intelligence; his conversion was consequent on the event here represented, but Raffaelle was justified in indicating that essential circumstance by an inscription, as there was no other mode of expressing it.

We have confined our observations on the Cartoons to the qualities of composition, character, and expression; parts of the art which may be considered purely intellectual, and which admit of being conveyed through the medium of engraving. Of the manual execution of the Cartoons, which can only be understood by an inspection of the originals, it may be observed, that having been executed when Raffaelle was in the zenith of his powers, they exhibit throughout the most consummate mastery and decision of hand, without any trace of that timidity which is visible in his earlier performances. The colouring has perhaps generally too great an inclination to red, although, even in this quality, there are occasionally passages of high excellence. At whatever distance they are seen, these Cartoons stand out with the noblest and most perspicuous effect, without the slightest alloy of complexity or littleness. The wish of men of taste that they may form the first ornament of the new National Gallery, when completed, cannot be too often enforced. It would be without excuse if the practice of our artists, or the taste of the public at large, should retrograde materially from just principles of art while such noble examples were before them.

THE MOON.—No. 2.

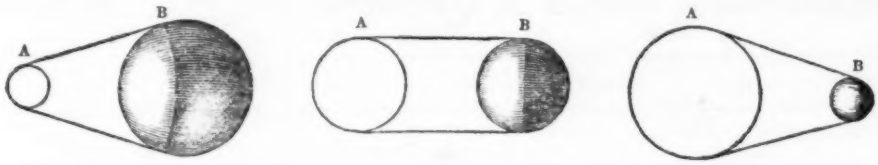
THE various methods by which the motions of the heavenly bodies are represented in popular treatises have this disadvantage, that not being strictly, sometimes not even nearly, correct, they are apt to leave false impressions upon the mind, *after* the time when it becomes necessary to abandon the first suppositions, and take up others which are nearer the truth. Thus we find it stated that the moon moves round the earth *uniformly*, in about twenty-seven days, eight hours, and three-quarters, and always in the same plane, which would lead the beginner to expect that if it *occulted*, or passed over any star in one month, it would occult the same star in the next month. Again, we speak of the moon's orbit as if it were a circle on the sphere of the heavens, which always retained its place, and of the moon's distance from the earth as if it were always the same. We may, however, lay down the following principles, which the reader must bear in mind in every part of this subject.

1. There is nothing in the solar system which does not undergo *sensible* variation, except the times of rotation of the planets round their own axes, the *average* distances of the planets from the sun and of the satellites from their primaries, and the *average* or *mean* times of revolution of the planets round the sun, and of the satellites round their primaries. By the mean time of revolution we mean the average of a large number of revolutions, one hundred for example: thus we should not find any sensible difference between one hundred years and another hundred; or between one hundred months and the next hundred: though there may be a slight difference between one year and the next, and a decided difference between one month and the next. To give a notion of the magnitudes of which we are speaking, we should call two minutes a slight difference between two years, and two hours a decided difference between two months. Even when we say that the mean distances and mean motions are invariable, we only mean that, within the time of human observations, no sensible variation has been observed. With regard to the moon there is a slight variation in her average motion, which though at present causing a difference of only about eleven seconds of a degree in a century, or about the 170th part of her apparent diameter, becomes sensible in a lapse of ages, and was discovered by comparing the asserted time of some Chaldean observations of eclipses, with the times at which these eclipses should have happened, if the *present* rate of motion were always strictly preserved.

2. All the variations which have yet been observed are *periodical*; that is, if, for example, the distance of a planet from the sun is now increasing, it will afterwards decrease, then again begin to increase, and so on. Even the acceleration of the moon's mean motion just alluded to, will in time be changed into a retardation. At one period the motion of Saturn is accelerated in a degree which depends upon the position of Jupiter; but then at another time it is as much retarded. We may add that, supposing the *mean* distances to be subject to very slight and slow periodical variations, it has been shown that they will never be all in their state of either increase or decrease at the same time; but that some must be increasing while others are decreasing.

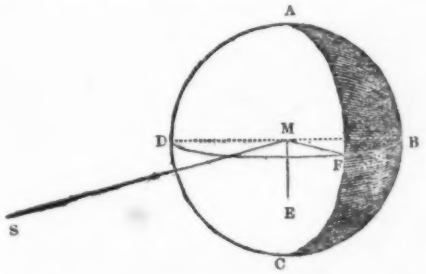
Whenever we talk of a motion as uniform, which is not really uniform, it is to be understood that, *with regard to the matter then immediately under consideration*, the want of uniformity makes no sensible difference in the *nature* of the result. Thus, when we come to speak of the moon's phases, we shall be very well able to explain the progress from new to full moon, and back again, without taking account of the irregularity. These will only affect the time of the phenomenon, and not the phenomenon itself. However varied the motion round the earth may be, provided it does move round, there will always be a new and full moon.

If one ball, A, is luminous, and throws its light upon another, B, if A be less than B, less than half of B will be illuminated; if A be equal to B, just half of B will be illuminated; and if A be greater than B, more than half of B will be illuminated. This is evident in the following diagram. At the same time, however great the ball

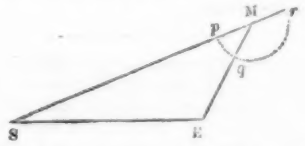


A may be, the further it is removed from B the less of B is illuminated; though if A be greater than B, never less than one half. Though the sun is much greater than the moon, yet its distance is so great that we may consider the moon as half illuminated.

In the following diagram, the eye of the spectator is looking at the moon from a point in the line M E, so that the hemisphere of the moon which is visible to him (or which would be, if completely illuminated,) is bounded by the circle A B C D. The line M S is drawn from the



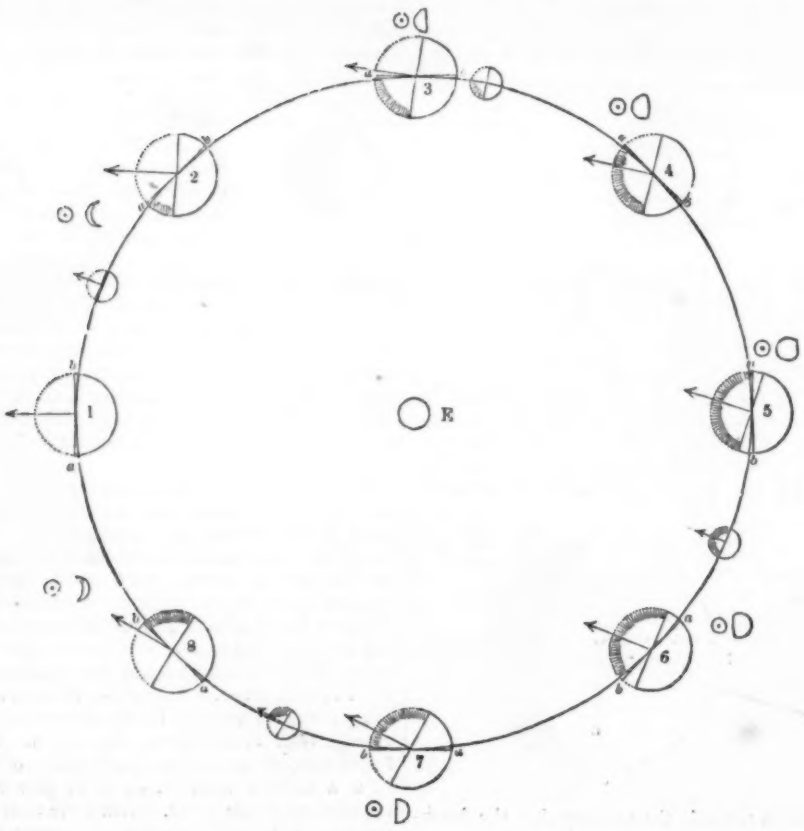
centre of the moon towards the sun, so that the boundary of the illuminated part, or as much of it as is seen from the earth, is A F C. Of the hemisphere, which would, if illuminated, be visible to him, A B C is not illuminated, and is therefore not visible, and A D C is visible. The size of the portion A B C depends upon the angle F M B, which is the same as the angle S M E, that is, the angle by which the sun is separated from the earth to a spectator at the centre of the moon; that is to say, the *dark* part of the moon is as great a proportion of the whole hemisphere as the angle under which a spectator at the centre of the moon sees the sun and earth, is of two right angles. Or more simply thus:



let S, E, and M represent the relative positions of the centres of the sun, earth, and moon, then drawing a semicircle *p q r*, *p q* represents the proportion of the moon's surface which is dark, and *q r* that which is enlightened. It must be observed, however, that the dark part is on the other side of the moon, not on that of *p q*; for on looking at the preceding figure we see that M E and M S both cut through the enlightened part of the moon. Inattention to this circumstance would make us place the dark and light parts on the wrong sides.

We now represent the real phenomena of a *lunation*, or period in which the moon goes through all its changes. We suppose the sun to move round the earth, instead of the earth round the sun, which will make no difference in the observed phenomena, as the reader will see on consulting the article on Relative Motion in numbers 43 and 44 of the Penny Magazine. A *sidereal* revolution (*sidus*, a star) of a heavenly body is the time in which it goes completely round the heavens, from a star to the same star again. The average or mean sidereal revolution of the sun, or the sidereal year, is 365 days, 6 hours, 9 minutes, and 10 seconds; the average or mean sidereal month, or revolution of the moon, is 27 days, 7 hours, 43 minutes, and 12 seconds. From which we may calculate, that while the moon moves round the heavens, the sun moves, on the average, through $26° \frac{9}{10}$.

In the diagram in the following page, in which the sun, moon, and earth are supposed to be in the same plane (a supposition near enough to the truth for our purpose), we trace, not the common month, or *lunation*, but the *sidereal* month; which we do, partly because we suppose many of our readers have studied the common diagram in which the phases are explained, while the sun remains stationary, and partly that they may the better see how the common month, lunation, or *synodical* month, arises. The earth is at E; the sun is so distant that it appears in the same direction from the centres both of the earth and moon. This is not a forced supposition, for the proper place of the sun would be at a distance from E, equal to four hundred times the distance of the moon. While the moon moves round the circle 1, 2, 3, &c. the sun moves round E more slowly, and the arrow which passes through the moon in the figure points to the sun in each position of the moon. The smaller circles represent the moon's equator, the enlightened part of which is dotted; while the part of the enlightened disc which is *seen from the earth* has a thin line of shading behind the dots. The boundaries of the face presented to the earth are at *a* and *b*. The reader must imagine the representation of the moon to be very much reduced in size. We first suppose the moon and sun to be both in the line passing through E and 1. No part of the enlightened hemisphere is then visible: it is new moon, and there is an eclipse of the sun. The reason why there is not always an eclipse of the sun at new moon is, that our supposition is wrong, and the sun is generally a little above or below E 1. The moon moves from 1 to 2. If the sun moved as fast, no part of the enlightened face would ever become visible; but the revolution of the sun being much slower, a part of the western edge of the enlight ened face becomes visible, producing the horned appear ance visible in the young moon, the horns being turned away from the sun. At 3, it is nearly half moon; it would have been quite so, had the sun remained still; but, as it is, the half moon will take place a little further on, which we have represented on a smaller scale. At half moon, the boundary diameter of the enlightened hemisphere would pass through the earth, if lengthened. When the moon comes to 4, nearly three-quarters of it, but not quite, will be visible. At 5 it is not quite full moon; which latter phenomenon will not be observed until some time after, as in the smaller moon, which follows 5. Were our diagram strictly true, there would be no full moon, but an eclipse of the moon at that point, since the earth would prevent the sun's rays reaching the moon. The sun is, however, as before observed, generally a little above or below the plane of the paper. The phenomena of the positions 6, 7, and 8, will now be easily



seen, but on coming to 1 again it will not be new moon, since the sun will have moved forward, and the moon must overtake it, as represented in the smaller figure. From this period the same changes recommence. During the first half of the month the horned or unfinished side of the moon is that which is furthest from the sun: during the latter half the unfinished part is nearest the sun.

We see then that the common month or *synodical* month is the sidereal month added to the time during which the moon can overtake the sun. This adds more than two days to the sidereal month; in fact, we have

	D.	H.	M.	S.
Average sidereal month...	27	7	43	12
„ synodical month..	29	12	44	3

Nevertheless, we must not expect to find the real lunations of the Calendar in exact agreement with the average last given. In the first place, the motion of the moon is not perfectly uniform; neither is that of the sun. In the winter, the sun is nearer the earth than in summer, and moves more rapidly. The winter lunations will therefore be longer than those of the summer, since the moon having described her actual revolution must follow the sun through a greater angle. This cause alone makes three or four hours of difference.

There is a very good illustration of a synodical revolution in the hands of a watch. These are together at twelve o'clock, and would be together at one, if the hour-hand remained stationary; but in the mean while the hour-hand has moved through five minutes, and the minute-hand will therefore take something more than five minutes before it overtakes the hour-hand. We shall find exactly how much it must move through, because, changing the numbers, any one who understands arithmetic may then deduce the synodical month from the sidereal month. Whatever the hour-hand moves through, the minute-hand moves through *twelve* times as much, because it moves twelve times as fast; but before the minute-hand can overtake the other, it must go completely round, and move through what the other has moved through besides; therefore one complete round of the minute-hand is *eleven* times the motion of the hour-hand before it is overtaken. That is, 60 minutes is eleven times what we are in search of; which latter is therefore $5\frac{5}{11}$ minutes.

Having thus described the phenomena which the moon presents, we shall proceed in our next to give an account of a paper by M. Arago on the question of the moon's influence on the weather.

Curious Clock.—The most curious thing in the cathedral of Lubeck is a clock of singular construction, and very high antiquity. It is calculated to answer astronomical purposes, representing the places of the sun and moon in the ecliptic, the moon's age, a perpetual almanac, and many other contrivances. The clock, as an inscription sets forth, was placed in the church upon Candlemas-day in 1405. Over the face of it appears an image of our Saviour, and on either side of the image are folding doors, so constructed as to fly open every day when the clock strikes twelve. At this hour, a set of figures representing the twelve apostles come out from the door on the left hand of the image, and pass by in review before it, each figure making its obeisance by bowing as it passes that of our Saviour, and afterwards entering the door on the right hand. When the procession terminates, the doors close.—*Clarke's Travels in Scandinavia.*

*** The Office of the Society for the Diffusion of Useful Knowledge is at 59, Lincoln's Inn Fields.

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Printed by WILLIAM CLOWES, Duke Street, Lambeth.